Appendix 1. Borehole Geophysical Logs

Abbreviations

Am-241	americium-241
API	American Petroleum Institute radioactivity unit
Be	beryllium
BLR	Big Lost River
BLS	below land surface
CPS	counts per second
Cs-137	cesium-137
Deg/min/sec	degrees/minutes/seconds
DEG F	degrees Fahrenheit
DEN(LS)	density long-spaced
DEN(SS)	density short-spaced
ESRP	Eastern Snake River Plain
ft	feet
Gam(Nat)	natural gamma
ID	Idaho
IDWR	Idaho Department of Water Resources
in	inch
INL	Idaho National Laboratory
LMP	land measurement point
LS	land surface
MN/TN	magnetic north/true north
NA	not available
NAD27	North American Datum of 1927
NAD83	North American Datum of 1983
Neutron(Am/Be)	neutron, americium/beryllium
NGVD	National Geodetic Vertical Datum
NGVD84	National Geodetic Vertical Datum of 1984
PVC	polyvinyl chloride
POR(NEU)	Porosity, neutron

SpC	specific conductance
SP COND	specific conductance
Temp	temperature
TOC	top of casing
US/CM	microsiemens per centimeter
USGS	U.S. Geological Survey

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 440649113565701	**Station name (C12)** IDWR-1	**Other ID** 09N 21E 14BBC1
County Butte	**State** ID	**Log date** 09/12/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 44° 06' 49" (deg/min/sec)	**Longitude** 113° 56' 57" (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 6,386 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 267 ft (drill log)	**Borehole diameter** NA	**Casing bottom** 267 ft BLS (driller log)
Casing diameter 16-in.	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 82.75 ft BLS	**at time** 9:00 9/12/2019

Hydrologic conditions Well drilled 1961. Ran video on 9/12/2019. Well open to 250 ft, sluff in well starts near 250 ft BLS. The water level measured near 82.75 ft BLS. Perforations in 16-in. casing, but could not see in video file.

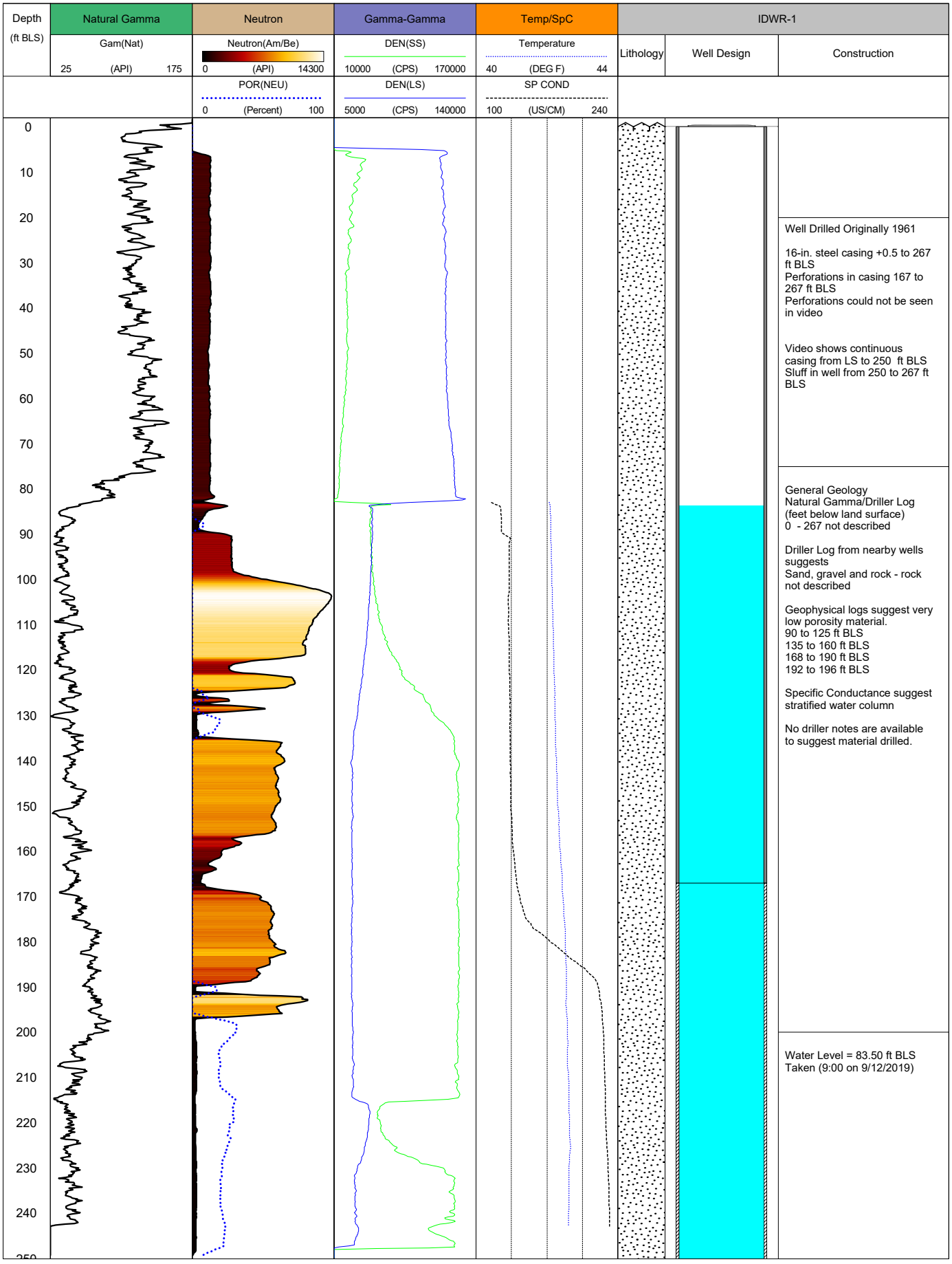
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 250 ft BLS; calibration date 5/2019.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 250 ft BLS

Tool run 3 9042 Temperature/SpC; Run form LS to 245 ft BLS

Remarks Water level near 83.50 ft BLS. Perforations could not be observed in well casing, sluff starts near 250 ft BLS. Drill log shows well was drilled to 267 ft BLS.



Well Drilled Originally 1961

16-in. steel casing +0.5 to 267 ft BLS
Perforations in casing 167 to 267 ft BLS
Perforations could not be seen in video

Video shows continuous casing from LS to 250 ft BLS
Sluff in well from 250 to 267 ft BLS

General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 - 267 not described

Driller Log from nearby wells suggests
Sand, gravel and rock - rock not described

Geophysical logs suggest very low porosity material.
90 to 125 ft BLS
135 to 160 ft BLS
168 to 190 ft BLS
192 to 196 ft BLS

Specific Conductance suggest stratified water column

No driller notes are available to suggest material drilled.

Water Level = 83.50 ft BLS
Taken (9:00 on 9/12/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 434847113284501	**Station name (C12)** IDWR-12	**Other ID** 06N 25E 33AAB1
County Butte	**State** ID	**Log date** 09/11/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 84' 47" (deg/min/sec)	**Longitude** 113° 28' 45" (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,810 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 403 ft (video)	**Borehole diameter** 12-in 450 ft BLS	**Casing bottom** 450 ft BLS (driller log)
Casing diameter 12-in. steel casing	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 206.13 ft BLS	**at time** 13:00 9/11/2019

Hydrologic conditions Well drilled in 1966. Ran video on 9/11/2019. Sluff in well starts near 403 ft BLS. Could not collect data from 403 to 450 ft BLS.

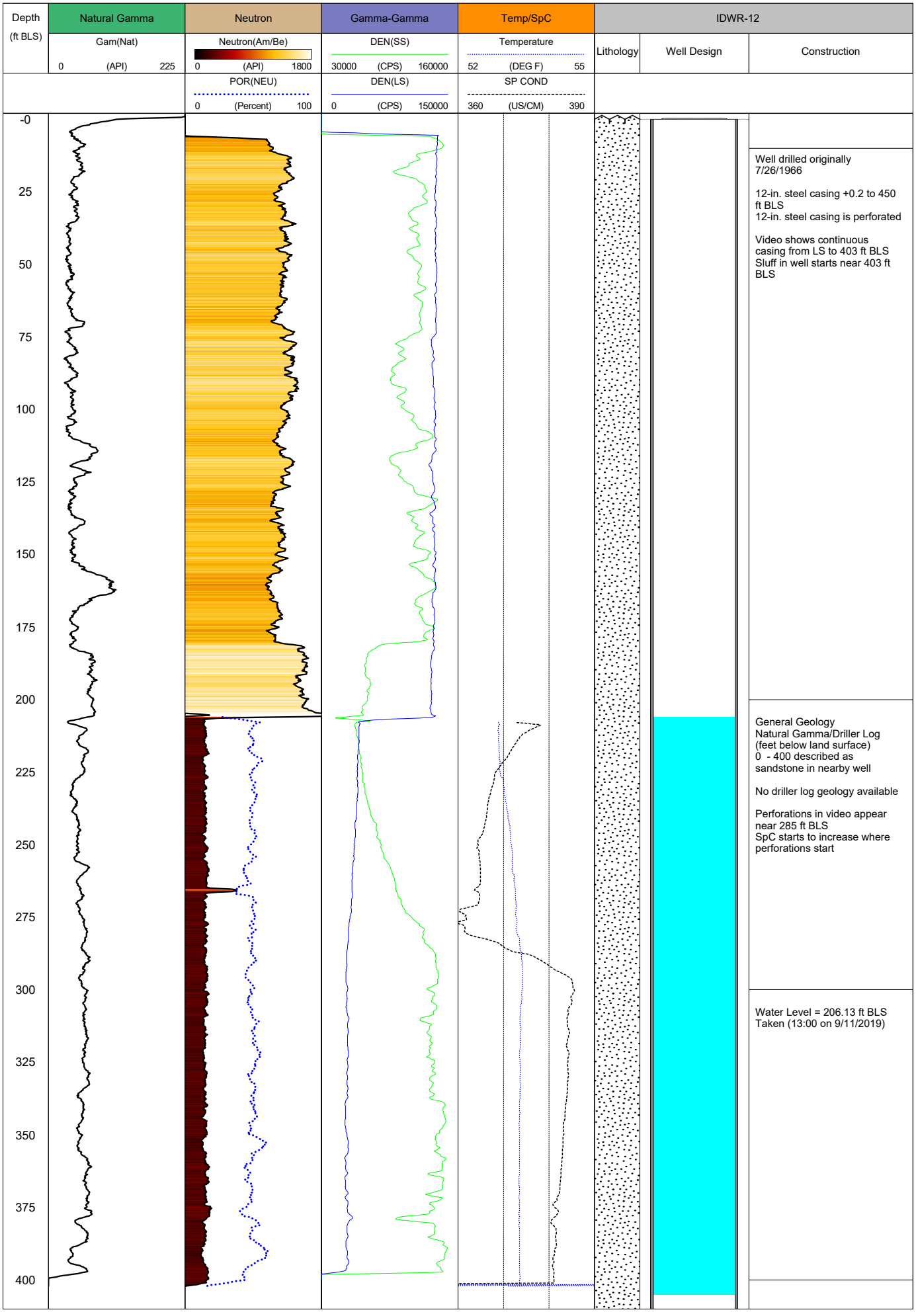
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 403 ft BLS; calibration date 5/2019. Used the log run at 14:41, this was the third log run.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 403 ft BLS

Tool run 3 9042 Specific Conductance and Temperture; run from LS to 403 ft BLS (Down log); calibration date 5/2019

Remarks Good water clarity observed in video. Water level on video near 206 ft BLS.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 225
Neutron
Neutron(Am/Be)
0 (API) 1800
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
30000 (CPS) 160000
DEN(LS)
0 (CPS) 150000
Temp/SpC
Temperature
52 (DEG F) 55
SP COND
360 (US/CM) 390
IDWR-12
Lithology
Well Design
Construction
-0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
Well drilled originally
7/26/1966
12-in. steel casing +0.2 to 450 ft BLS
12-in. steel casing is perforated
Video shows continuous casing from LS to 403 ft BLS
Sluff in well starts near 403 ft BLS
General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 - 400 described as sandstone in nearby well
No driller log geology available
Perforations in video appear near 285 ft BLS
SpC starts to increase where perforations start
Water Level = 206.13 ft BLS
Taken (13:00 on 9/11/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 434713113230601	**Station name (C12)** IDWR-15	**Other ID** 05N 26E 05DCB1
County Butte	**State** ID	**Log date** 09/11/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 47’ 13” (deg/min/sec)	**Longitude** 113° 23’ 06” (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,592 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 260 ft (drill log)	**Borehole diameter** 20-in 260 ft BLS	**Casing bottom** 260 ft BLS (driller log)
Casing diameter 20-in. steel casing	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 57.79 ft BLS	**at time** 16:30 9/11/2019

Hydrologic conditions Well drilled in 1967. Ran video on 9/11/2019. Sluff in well starts near 132 ft BLS. Could not collect data from 132 to 260 ft BLS.

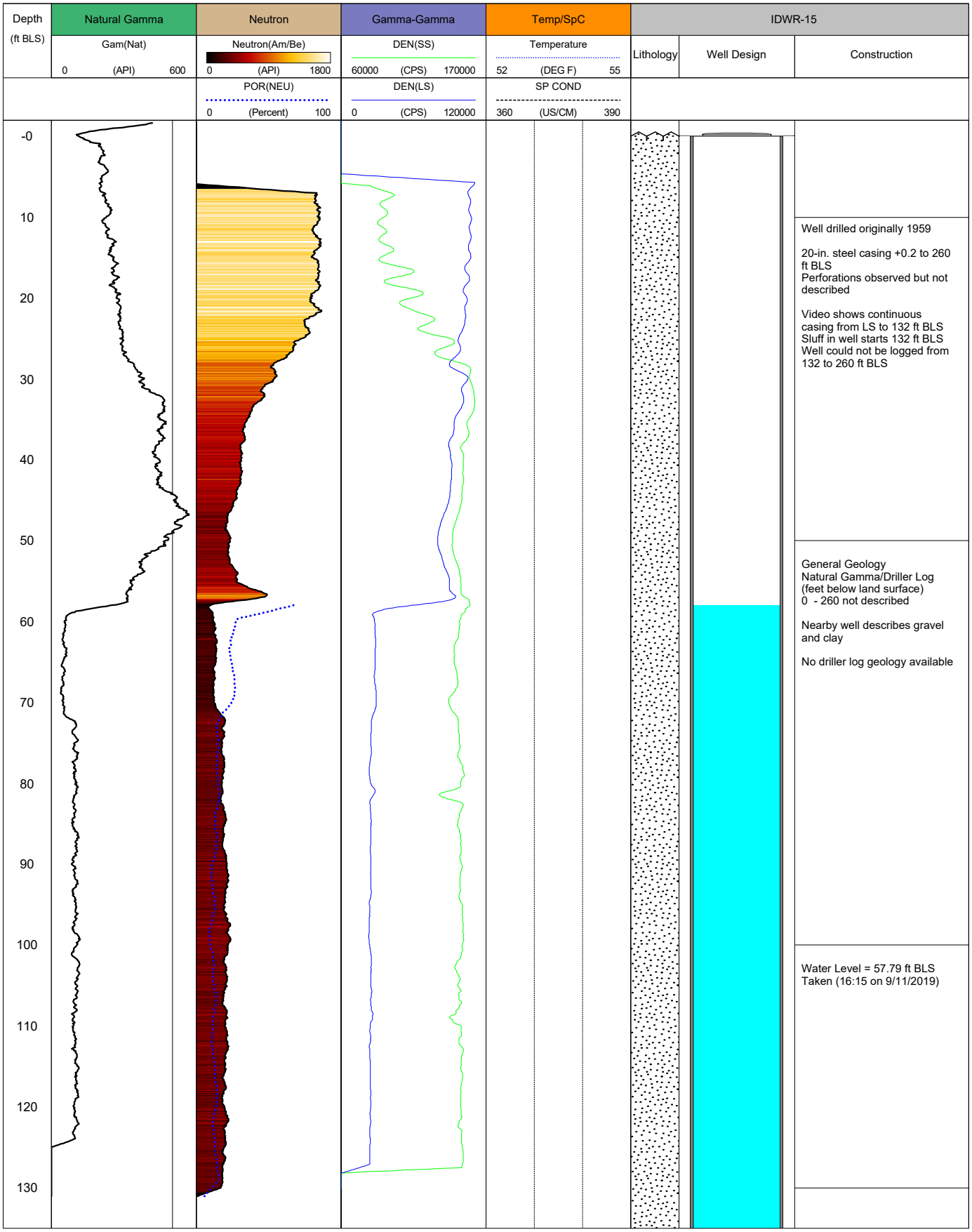
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 130 ft BLS; calibration date 5/2019.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 130 ft BLS

Tool run 3

Remarks Good water clarity observed in video. Water level on video near 58 ft BLS. Sluff in borehole starts near 132 ft BLS. Perforations observed in well casing. Casing size (20-in.) appears to have muted neutron reponse, lower than normal. Difficult to interpret geology based on geophysical data collected.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 600
Neutron
Neutron(Am/Be)
0 (API) 1800
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
60000 (CPS) 170000
DEN(LS)
0 (CPS) 120000
Temp/SpC
Temperature
52 (DEG F) 55
SP COND
360 (US/CM) 390
IDWR-15
Lithology
Well Design
Construction
-0
10
20
30
40
50
60
70
80
90
100
110
120
130
Well drilled originally 1959
20-in. steel casing +0.2 to 260 ft BLS
Perforations observed but not described
Video shows continuous casing from LS to 132 ft BLS
Sluff in well starts 132 ft BLS
Well could not be logged from 132 to 260 ft BLS
General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 - 260 not described
Nearby well describes gravel and clay
No driller log geology available
Water Level = 57.79 ft BLS
Taken (16:15 on 9/11/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 434436113193901	**Station name (C12)** IDWR-17	**Other ID** 05N 26E 23CDA1
County Butte	**State** ID	**Log date** 09/11/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 44' 36" (deg/min/sec)	**Longitude** 113° 19' 30" (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,488 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 203 ft (drill log)	**Borehole diameter** NA	**Casing bottom** 203 ft BLS (driller log)
Casing diameter 20-in./16-in.	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 206.13 ft BLS	**at time** 13:00 9/11/2019

Hydrologic conditions Well drilled 1949. Ran video on 9/11/2019. Well open to 170 ft and deeper, old pipe in well starts near 164 ft BLS and could not log past this point. The water level measured near 30.53 ft BLS.

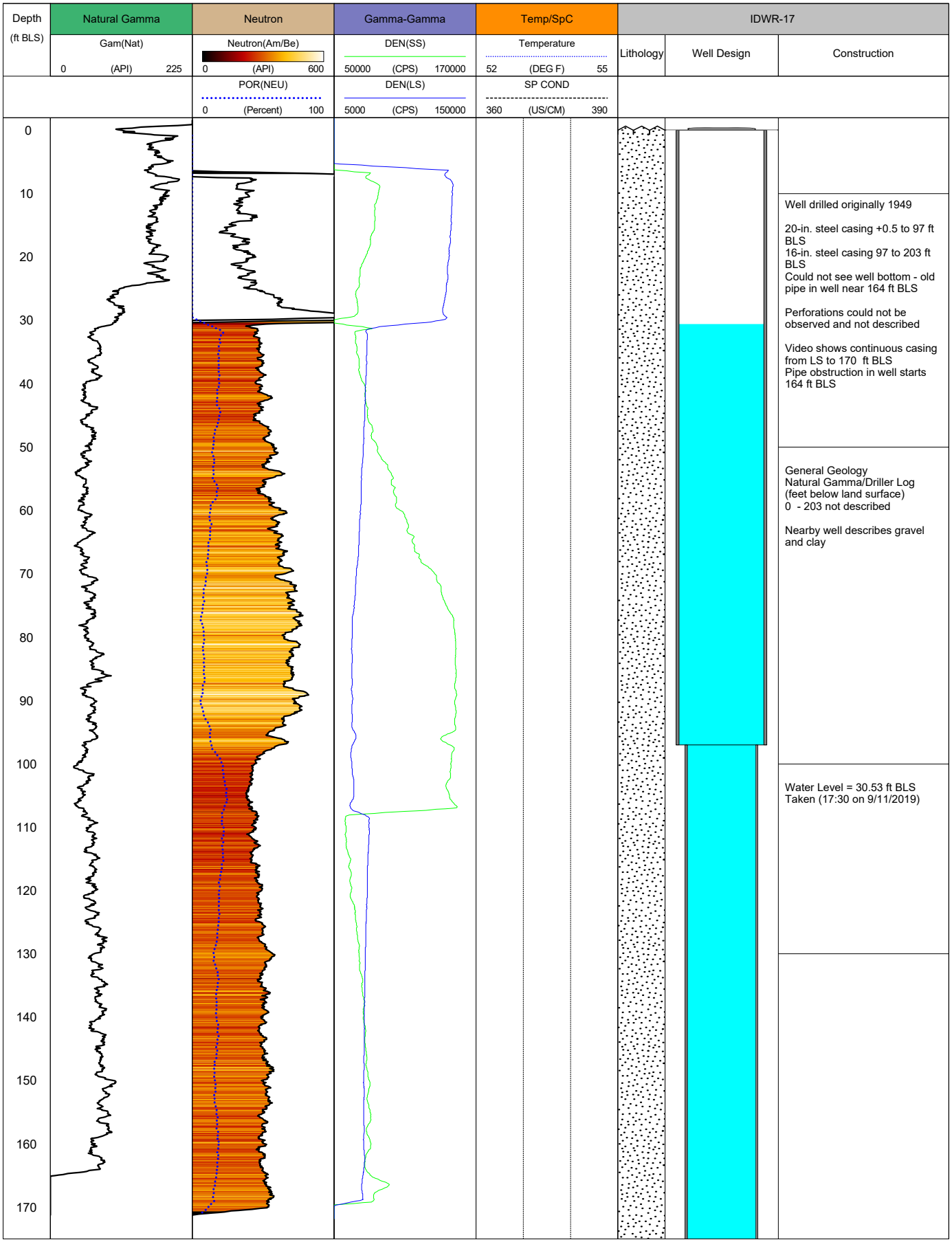
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 171 ft BLS; calibration date 5/2019.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 171 ft BLS

Tool run 3

Remarks Water level on video near 30.53 ft BLS. Old pipe in well starts near 164 ft BLS. Perforations could not be observed in well casing. Driller notes not well documented. Well appears to neck down near 97 ft BLS in video, not confirmed on casing size.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 225
Neutron
Neutron(Am/Be)
0 (API) 600
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
50000 (CPS) 170000
DEN(LS)
5000 (CPS) 150000
Temp/SpC
Temperature
52 (DEG F) 55
SP COND
360 (US/CM) 390
IDWR-17
Lithology
Well Design
Construction
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Well drilled originally 1949
20-in. steel casing +0.5 to 97 ft BLS
16-in. steel casing 97 to 203 ft BLS
Could not see well bottom - old pipe in well near 164 ft BLS
Perforations could not be observed and not described
Video shows continuous casing from LS to 170 ft BLS
Pipe obstruction in well starts 164 ft BLS
General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 - 203 not described
Nearby well describes gravel and clay
Water Level = 30.53 ft BLS
Taken (17:30 on 9/11/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 434001113215201	**Station name (C12)** IDWR-22	**Other ID** 04N 26E 21ABB1
County Butte	**State** ID	**Log date** 09/11/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 40' 01" (deg/min/sec)	**Longitude** 113° 21' 52" (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,590 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 721 ft (video)	**Borehole diameter** 6-in 640 ft / 4-in 760 ft	**Casing bottom** 760 ft BLS (driller log)
Casing diameter 6-in/4-in. steel casing	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 599.62 ft BLS	**at time** 7:50 9/11/2019

Hydrologic conditions Well re-drilled in 1969. Ran video on 9/11/2019 - could not see perforations. Sluff in well starts near 720 ft bls. Driller log shows perforations from 656 to 661 and from 685 to 690 ft bls, the rest of the well is cased.

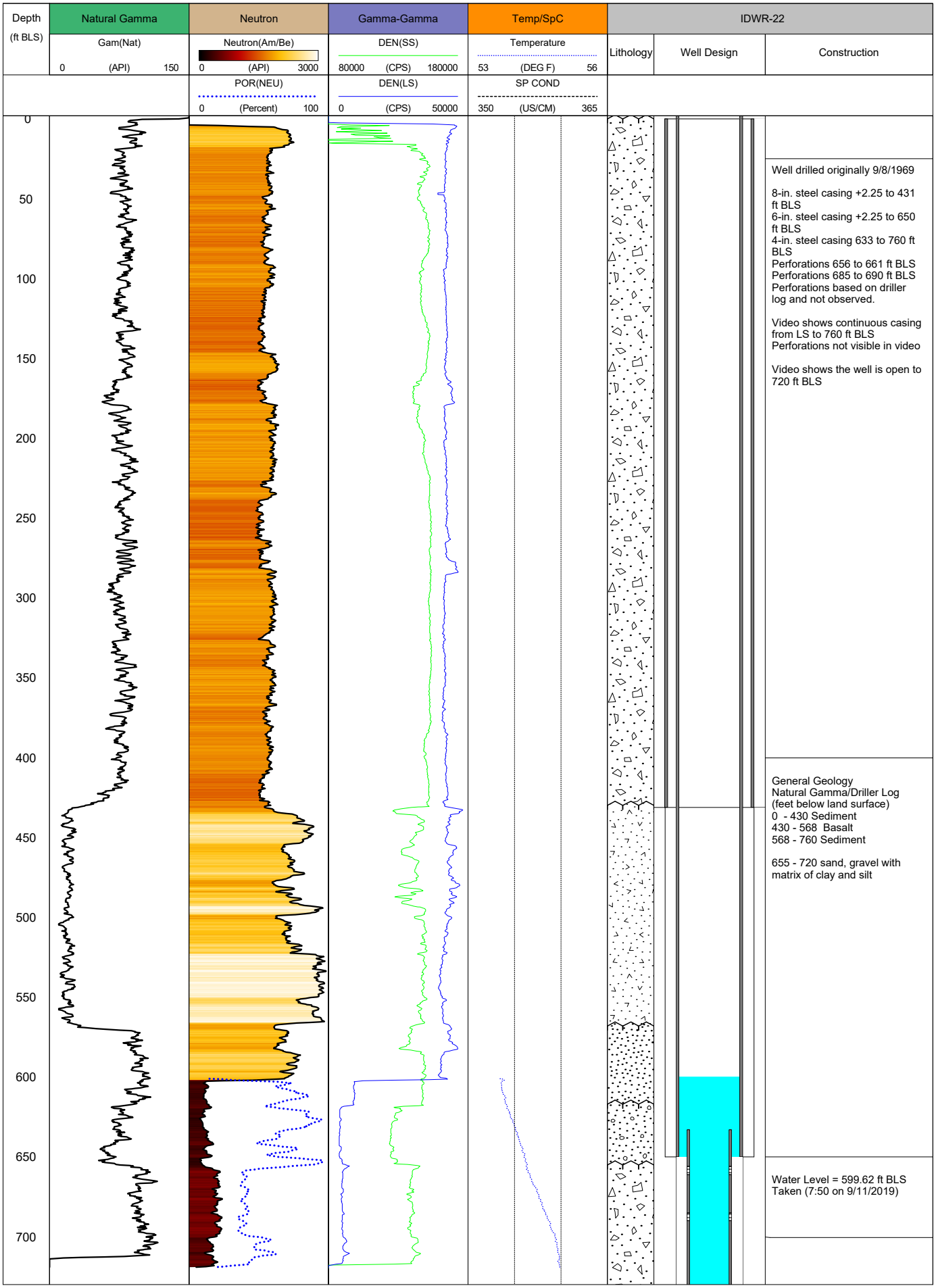
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 720 ft BLS; calibration date 5/2019

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 720 ft BLS

Tool run 3

Remarks Rusted and mineralized casing with debris in borehole. Water level on video near 601.2 ft BLS. Video camera hung up on transducer when coming out of the borehole.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 150
Neutron
Neutron(Am/Be)
0 (API) 3000
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
80000 (CPS) 180000
DEN(LS)
0 (CPS) 50000
Temp/SpC
Temperature
53 (DEG F) 56
SP COND
350 (US/CM) 365
IDWR-22
Lithology
Well Design
Construction
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Well drilled originally 9/8/1969
8-in. steel casing +2.25 to 431 ft BLS
6-in. steel casing +2.25 to 650 ft BLS
4-in. steel casing 633 to 760 ft BLS
Perforations 656 to 661 ft BLS
Perforations 685 to 690 ft BLS
Perforations based on driller log and not observed.
Video shows continuous casing from LS to 760 ft BLS
Perforations not visible in video
Video shows the well is open to 720 ft BLS
General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 - 430 Sediment
430 - 568 Basalt
568 - 760 Sediment
655 - 720 sand, gravel with matrix of clay and silt
Water Level = 599.62 ft BLS
Taken (7:50 on 9/11/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 433819113191601	**Station name (C12)** IDWR-25	**Other ID** 04N 26E 26DCD1
County Butte	**State** ID	**Log date** 11/19/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 38’ 19” (deg/min/sec)	**Longitude** 113° 19’ 16” (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,332 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 143 ft (drill log)	**Borehole diameter** NA	**Casing bottom** 143 ft BLS (driller log)
Casing diameter 6-in.	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Matt Gilbert / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 45.77 ft BLS	**at time** 12:55 on 11/19/2019

Hydrologic conditions Ran video on 11/19/2019. Well open to 143 ft, obstruction from 136 to 143 ft BLS. The water level measured near 46 ft BLS.

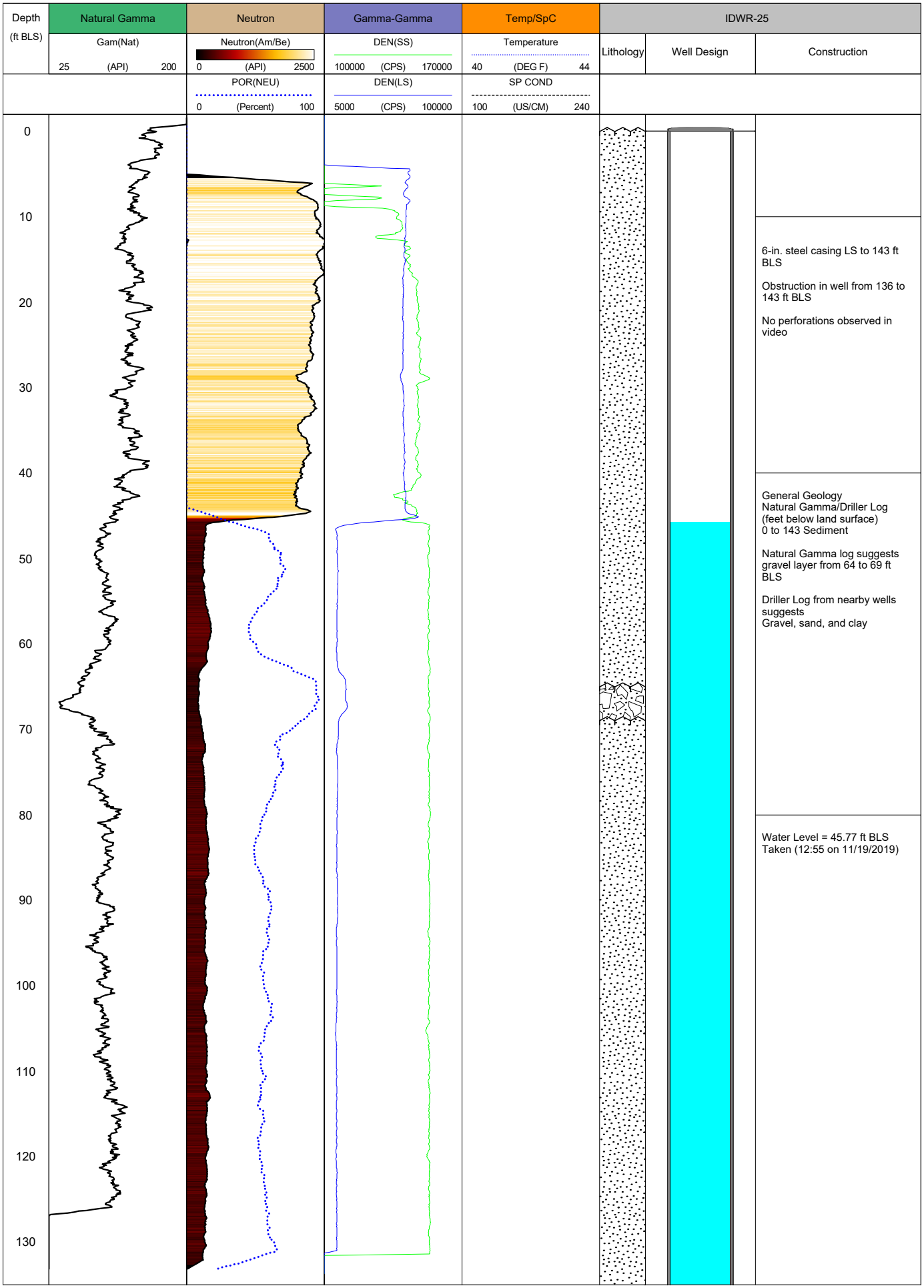
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 133 ft BLS; calibration date 5/2019.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 133 ft BLS

Tool run 3

Remarks Water level 45.77 ft BLS. Well information suggests well is cased to 143 ft BLS. Well very murky, no perforations observed.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
25 (API) 200
Neutron
Neutron(Am/Be)
0 (API) 2500
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
100000 (CPS) 170000
DEN(LS)
5000 (CPS) 100000
Temp/SpC
Temperature
40 (DEG F) 44
SP COND
100 (US/CM) 240
IDWR-25
Lithology
Well Design
Construction
0
10
20
30
40
50
60
70
80
90
100
110
120
130
6-in. steel casing LS to 143 ft BLS
Obstruction in well from 136 to 143 ft BLS
No perforations observed in video
General Geology
Natural Gamma/Driller Log (feet below land surface)
0 to 143 Sediment
Natural Gamma log suggests gravel layer from 64 to 69 ft BLS
Driller Log from nearby wells suggests
Gravel, sand, and clay
Water Level = 45.77 ft BLS
Taken (12:55 on 11/19/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 433657113201001	**Station name (C12)** IDWR-28	**Other ID** 03N 26E 03DAA1
County Butte	**State** ID	**Log date** 09/10/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 36' 57" (deg/min/sec)	**Longitude** 113° 20' 10" (deg/min/sec)	**Lat/Long datum** NAD
Altitude LMP 5,349 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 300 ft (video)	**Borehole diameter** 16-in. borehole	**Casing bottom** 300 ft BLS (video log)
Casing diameter 16-in. steel casing	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 208.64 ft BLS	**at time** 16:15 9/10/2019

Hydrologic conditions Well re-drilled in 1990 - some new information. Ran video on 9/10/2019 - could not see perforations. It appears there are holes in the casing. Video shows the well ends near 300 ft BLS - lots of sluff in borehole after this depth.

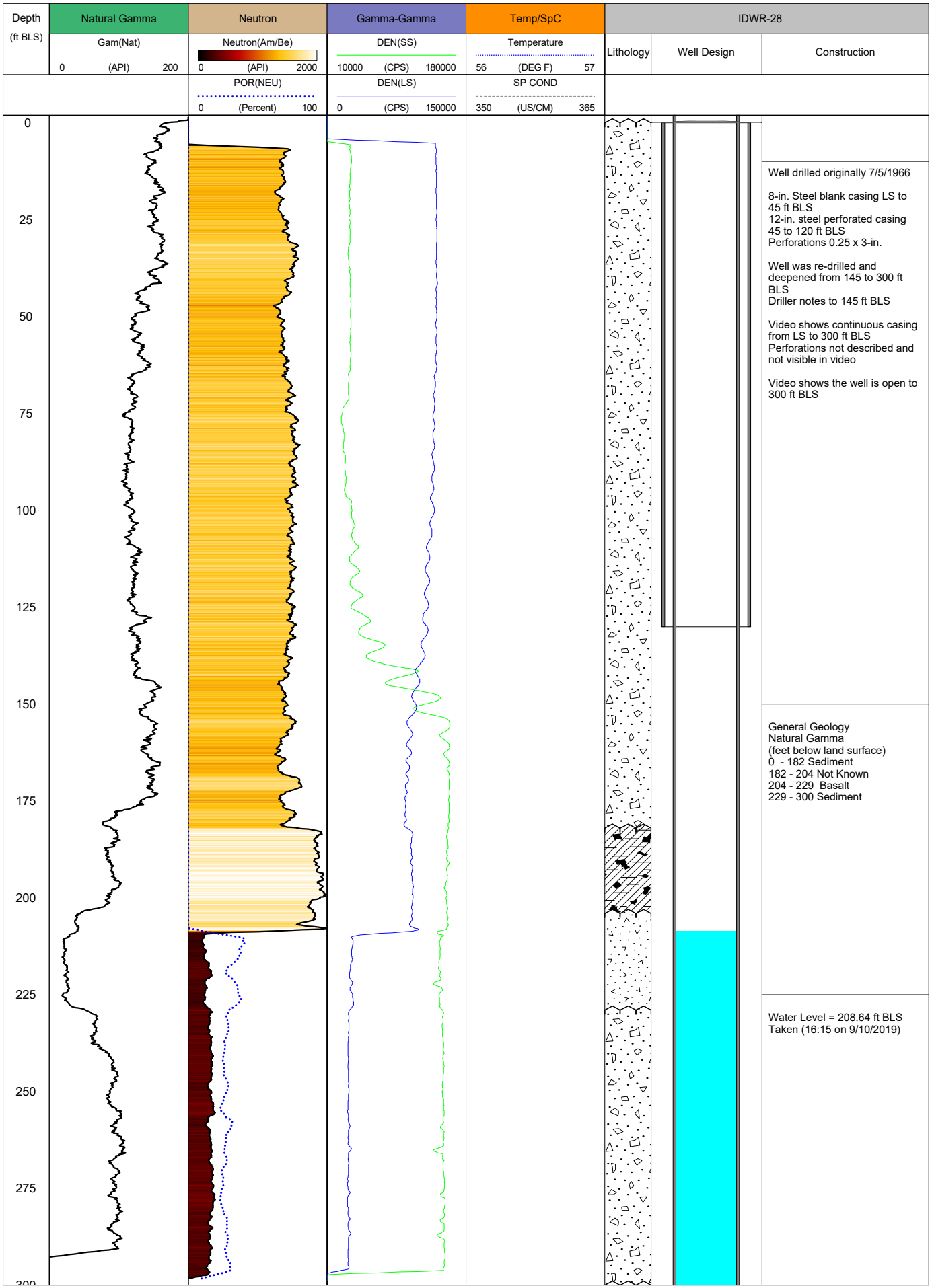
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 300 ft BLS; calibration date 5/2019

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 300 ft BLS

Tool run 3

Remarks Rusted and mineralized casing with debris in borehole. Water level on video near 208.6 ft BLS.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 200
Neutron
Neutron(Am/Be)
0 (API) 2000
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
10000 (CPS) 180000
DEN(LS)
0 (CPS) 150000
Temp/SpC
Temperature
56 (DEG F) 57
SP COND
350 (US/CM) 365
IDWR-28
Lithology
Well Design
Construction
0
25
50
75
100
125
150
175
200
225
250
275
Well drilled originally 7/5/1966
8-in. Steel blank casing LS to 45 ft BLS
12-in. steel perforated casing 45 to 120 ft BLS
Perforations 0.25 x 3-in.
Well was re-drilled and deepened from 145 to 300 ft BLS
Driller notes to 145 ft BLS
Video shows continuous casing from LS to 300 ft BLS
Perforations not described and not visible in video
Video shows the well is open to 300 ft BLS
General Geology
Natural Gamma
(feet below land surface)
0 - 182 Sediment
182 - 204 Not Known
204 - 229 Basalt
229 - 300 Sediment
Water Level = 208.64 ft BLS
Taken (16:15 on 9/10/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1)	**Station name (C12)** IDWR-31	**Other ID** 03N 25E 16ACC1
County Butte	**State** ID	**Log date** 09/10/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 35' 21" (deg/min/sec)	**Longitude** 113° 29' 02" (deg/min/sec)	**Lat/Long datum** NAD83
Altitude LMP 5,520 ft (approximate)	**Altitude datum** NGVD84	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 415 ft BLS (video)	**Borehole diameter** 6-in borehole	**Casing bottom** 424 ft BLS (driller notes)
Casing diameter 5-in. PVC liner	**Casing type** PVC	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Brian Twining	**Observed by** NA	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 333.28 ft BLS	**at time** 13:00 (approx) 9/10/2019

Hydrologic conditions Well drilled 7/20/2018. Ran video first and showed screened interval from 315 to 415 ft BLS.

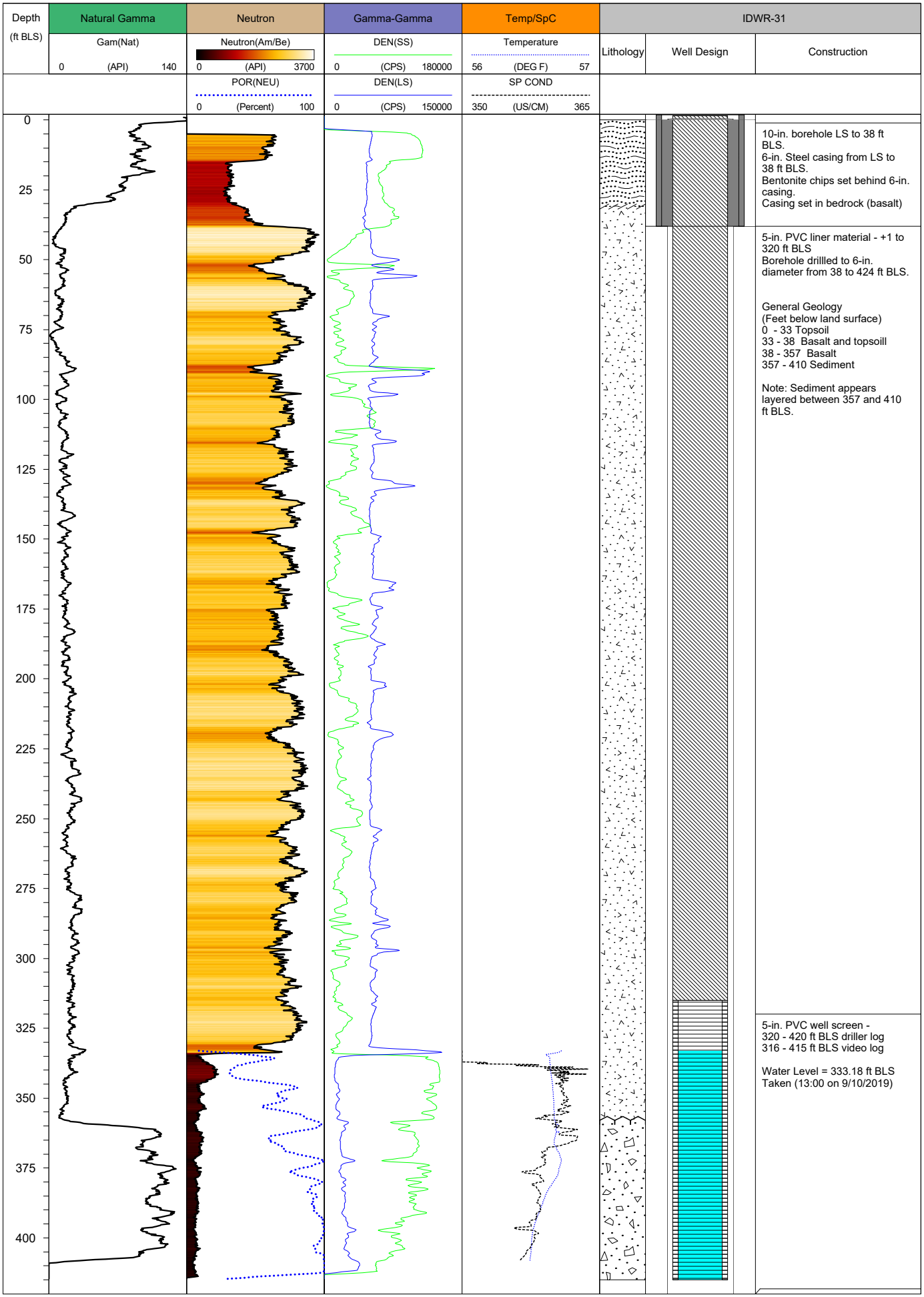
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9042 SpC / Temperature - calibration date 5/2019

Tool run 2 9057 Neutron/Natural Gamma (Am-241/Be source - 1.0 curie) - calibration date 5/2019

Tool run 3 0024 Gamma-gamma density (Cs-137 srouce - 0.2 curie)

Remarks Logs taken after the pump was recently pulled. SpC and Temperature run in disturbed borehole. Pump was being pulled when we showed up.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 140
Neutron
Neutron(Am/Be)
0 (API) 3700
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
0 (CPS) 180000
DEN(LS)
0 (CPS) 150000
Temp/SpC
Temperature
56 (DEG F) 57
SP COND
350 (US/CM) 365
IDWR-31
Lithology
Well Design
Construction
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
10-in. borehole LS to 38 ft BLS.
6-in. Steel casing from LS to 38 ft BLS.
Bentonite chips set behind 6-in. casing.
Casing set in bedrock (basalt)
5-in. PVC liner material - +1 to 320 ft BLS
Borehole drillled to 6-in. diameter from 38 to 424 ft BLS.
General Geology
(Feet below land surface)
0 - 33 Topsoil
33 - 38 Basalt and topsoill
38 - 357 Basalt
357 - 410 Sediment
Note: Sediment appears layered between 357 and 410 ft BLS.
5-in. PVC well screen -
320 - 420 ft BLS driller log
316 - 415 ft BLS video log
Water Level = 333.18 ft BLS
Taken (13:00 on 9/10/2019)

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1)	**Station name (C12)** IDWR-32	**Other ID** 03N 26E 16ABB1
County Butte	**State** ID	**Log date** 09/10/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 35’ 41” (deg/min/sec)	**Longitude** 113° 21’ 56” (deg/min/sec)	**Lat/Long datum** NAD83
Altitude LMP 5,340 ft (approximate)	**Altitude datum** NGVD84	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 545 ft (video)	**Borehole diameter** 6-in borehole	**Casing bottom** 578 ft BLS (driller log)
Casing diameter 6-in. steel casing	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Matt Gilbert / Jayson Bloom	**Observed by** NA	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 447.07 ft BLS	**at time** 10:15 11/19/2019

Hydrologic conditions Well drilled August 12, 2019 to September 25, 2019. Ran video on 11/19/2019 - could not see perforations. It appears there are holes in the casing. Video shows the well has blockage near 542 ft BLS - lots of sluff in borehole after this depth. Video stops at 545 ft BLS.

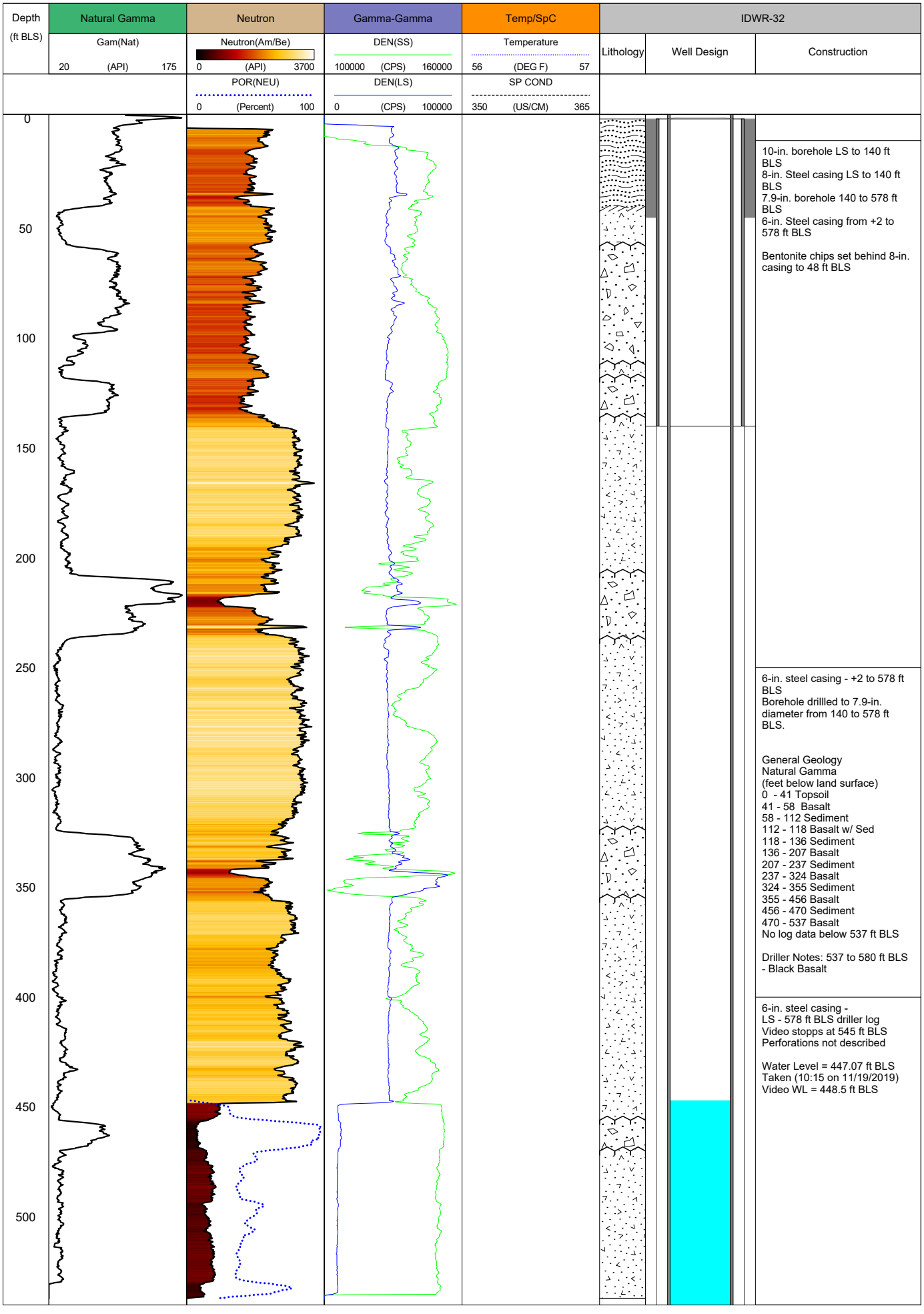
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 537 ft BLS; calibration date 5/2019

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 537 ft BLS

Tool run 3

Remarks Logs taken after recently drilled. SpC and Temperature were not run in disturbed borehole. Lots of debris in borehole, see sanding problems in well.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
20 (API) 175
Neutron
Neutron(Am/Be)
0 (API) 3700
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
100000 (CPS) 160000
DEN(LS)
0 (CPS) 100000
Temp/SpC
Temperature
56 (DEG F) 57
SP COND
350 (US/CM) 365
IDWR-32
Lithology
Well Design
Construction
0
50
100
150
200
250
300
350
400
450
500
10-in. borehole LS to 140 ft BLS
8-in. Steel casing LS to 140 ft BLS
7.9-in. borehole 140 to 578 ft BLS
6-in. Steel casing from +2 to 578 ft BLS
Bentonite chips set behind 8-in. casing to 48 ft BLS
6-in. steel casing - +2 to 578 ft BLS
Borehole drillled to 7.9-in. diameter from 140 to 578 ft BLS.
General Geology
Natural Gamma
(feet below land surface)
0 - 41 Topsoil
41 - 58 Basalt
58 - 112 Sediment
112 - 118 Basalt w/ Sed
118 - 136 Sediment
136 - 207 Basalt
207 - 237 Sediment
237 - 324 Basalt
324 - 355 Sediment
355 - 456 Basalt
456 - 470 Sediment
470 - 537 Basalt
No log data below 537 ft BLS
Driller Notes: 537 to 580 ft BLS - Black Basalt
6-in. steel casing -
LS - 578 ft BLS driller log
Video stopps at 545 ft BLS
Perforations not described
Water Level = 447.07 ft BLS
Taken (10:15 on 11/19/2019)
Video WL = 448.5 ft BLS

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BOREHOLE GEOPHYSICAL LOG

English/Metric units English

SiteID (C1) 433448113171001	**Station name (C12)** IDWR-33	**Other ID** 03N 27E 19ABB1
County Butte	**State** ID	**Log date** 11/19/2019
Owner No personal identification information		**Project** BLR USGS/IDWR
Location description Big Lost River / Arco / Mackay		
Latitude 43° 34' 48" (deg/min/sec)	**Longitude** 113° 17' 10" (deg/min/sec)	**Lat/Long datum** NAD27
Altitude LMP 5,272 ft	**Altitude datum** NGVD	**Log measurement point (LMP)** LS/TOC
Height LMP Depth below (-) /above (+) LS	**Description of LMP** Land surface, top of casing	
Borehole depth 256 ft (drill log)	**Borehole diameter** NA	**Casing bottom** 192 ft BLS (driller log)
Casing diameter 6-in.	**Casing type** Carbon Steel	**Source of data** IDWR
Logging unit USGS	**Log orientiation** MN/TN	**Magnetic declination** NA
Recorded by Matt Gilbert / Jayson Bloom	**Observed by** Will Parham	
Software non-ASCII logs Century	**Type of log** Century	
Fluid type ESRP Aquifer	**Fluid depth below LMP** 176.27 ft BLS	**at time** 11/19/2019

Hydrologic conditions Ran video on 11/19/2019. Well open to 214 ft, casing stops at 192 ft BLS. Source logging stopped at 192 ft BLS, could not go into open borehole. The water level measured near 176.27 ft BLS.

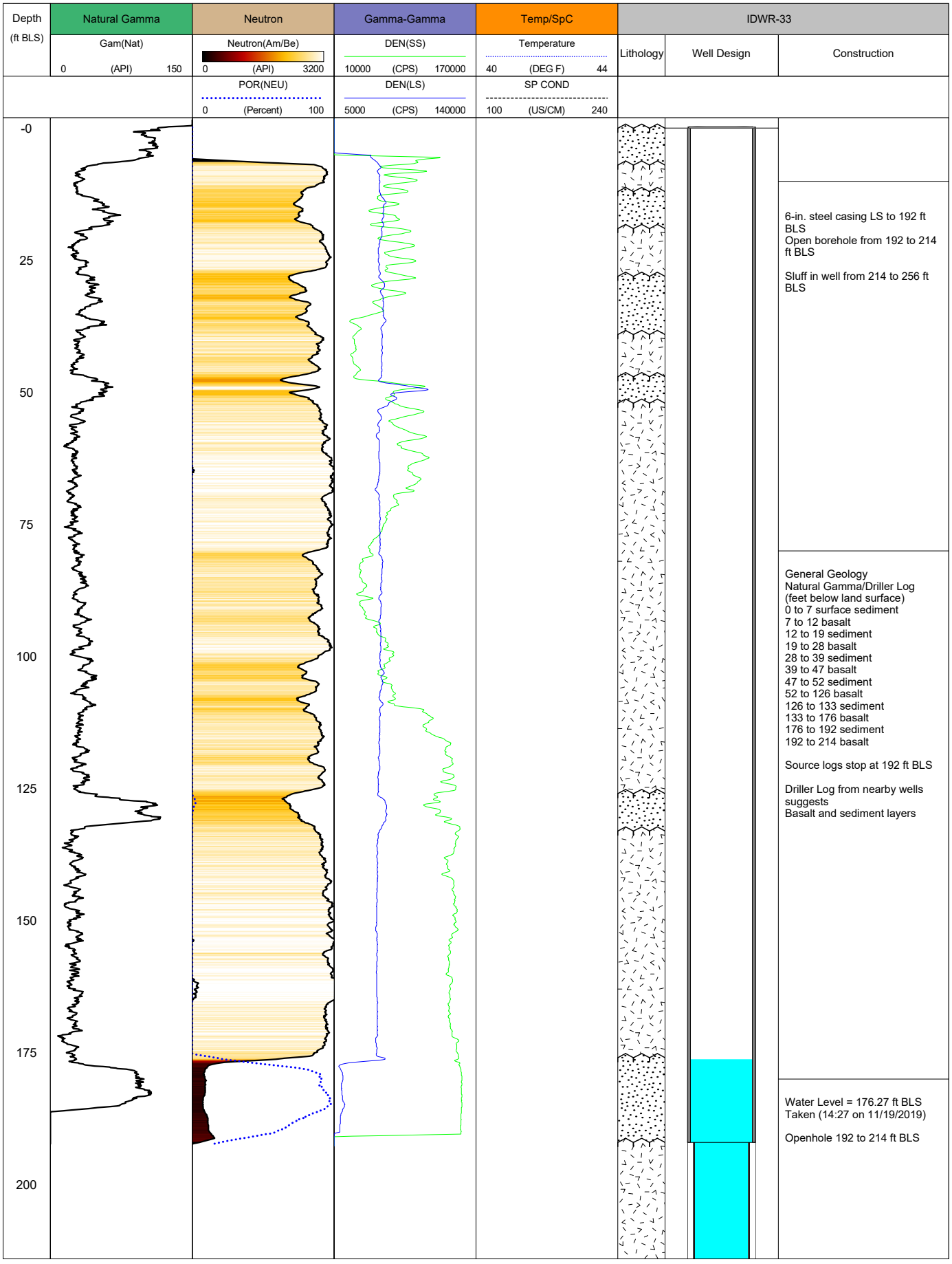
Tool manufacturer and model, tool serial number, log date and time, logging direction and speed, depth error after logging, log parameter(s) and date(s) of calibration check

Tool run 1 9057 Neutron (Am-241/Be - 1.0 curie) / Natural Gamma; Run from LS to 192 ft BLS; calibration date 5/2019.

Tool run 2 0024 Gamma-gamma density (Cs-137 source - 0.2 curie); Run from LS to 192 ft BLS

Tool run 3

Remarks Water level 176.27 ft BLS. Drill log and video are not consistent - video shows open hole from 192 to 214 ft BLS; driller log suggest well is cased to 256 and perforated casing from 220 to 242 ft BLS.
Video shows rock (basalt?) from 192 to 214 ft BLS.


Depth
(ft BLS)
Natural Gamma
Gam(Nat)
0 (API) 150
Neutron
Neutron(Am/Be)
0 (API) 3200
POR(NEU)
0 (Percent) 100
Gamma-Gamma
DEN(SS)
10000 (CPS) 170000
DEN(LS)
5000 (CPS) 140000
Temp/SpC
Temperature
40 (DEG F) 44
SP COND
100 (US/CM) 240
IDWR-33
Lithology
Well Design
Construction
-0
25
50
75
100
125
150
175
200
6-in. steel casing LS to 192 ft BLS
Open borehole from 192 to 214 ft BLS
Sluff in well from 214 to 256 ft BLS
General Geology
Natural Gamma/Driller Log
(feet below land surface)
0 to 7 surface sediment
7 to 12 basalt
12 to 19 sediment
19 to 28 basalt
28 to 39 sediment
39 to 47 basalt
47 to 52 sediment
52 to 126 basalt
126 to 133 sediment
133 to 176 basalt
176 to 192 sediment
192 to 214 basalt
Source logs stop at 192 ft BLS
Driller Log from nearby wells suggests
Basalt and sediment layers
Water Level = 176.27 ft BLS
Taken (14:27 on 11/19/2019)
Openhole 192 to 214 ft BLS